Reco Status and Plans

- Introduction
- Current Status
  - "Before" this week (p10)
  - "After" this week (p11)
- Schedule
- Issues
  - Current Performance
  - Current Manpower
  - Project Management
  - Run IIb
- Conclusions

Introduction

- **RECO** is DØ's official offline reconstruction program.

- It is developed by the "Algorithms" group, made up of Algo and Object ID groups.

- **RECO** is responsible for reconstructing all *physics object candidates* to be used in physics analyses.

- The input is the *Raw Data Chunk* (collider or MC)

- The output from **RECO** is the *DST* (goal: 125 Kb / event) and *Thumbnail* (goal: 12.5 Kb / event).

- http://www-d0.fnal.gov/computing/algorithms/

Current Status ("Before" this week)

- Currently running version p10.15.01
  - Unpacks all existing detectors / electronics
  - Reconstructs all basic detector objects (clusters, hits, etc.) with calibration / alignment applied (non-db based)
  - Reconstructs all basic *low level* physics objects (tracks, vertices)
  - Reconstructs all basic *high level* physics objects (em, mu, tau, met, jets, bid)
  - Results presented at Winter Conferences
- Near-complete focus for p10 was dealing with new detector
  - New apparatus, new electronics, new operating environment
  - Rapidly changing hardware / electronics status required corresponding responses
  - Very challenging "development" environment
- RECO does not yet produce a DST or Thumbnail
  - "DST" = RECO output = 1000 Kb + (> x10 of DST goal)
  - "Thumbnail" = reco_analyze root tuple = 40 Kb + (> x4 of TMB goal)

Current Status ("After" this week)

- Currently building p11.07.00, Many major new features:
  - Detectors
    - Alignment
      - SMT, CFT: Version 1 of alignment with tracks
      - MUO: Visual survey constants
      - Global coordinate system implemented
    - SMT / CFT cluster errors
    - Calorimeter non-linearity corrections (+ scale)
  - Tracking
    - Allow misses in CFT
    - Additional paths: SMT overlap tracking, H disk extensions
    - "Best" tracks now in "chunk 401"
    - Non-uniform field fitting, field polarity from database
    - Offset beam position
    - Interacting propagator to muon system
    - Smoothing refitter
    - CFT cluster angle corrections
    - Global cuts set via rcp (e.g. min pT)
  - Vertexing
    - Use "best tracks"
    - Provide vertices are all other track types
    - Tuned parameters

Current Status ("After" this week)

- Electrons
  - Will use / study non-linear calorimeter corrections (nlc)
- Muons
  - Allow "scintillator-only segments"
    - fills gaps in the wire chamber coverage
  - Allow BC-only tracks
    - increases coverage by not requiring A layer
  - Use global matching with the full GTrack and Muon::Track error
  - Use calibrated PDT t_0
  - Fix charge (use correct sense of field based on db info)
- Jets / MET
  - Calorimeter nlc
- Taus / bc jets
  - "same" as p10
- Thumbnail (Version 1)

Current Status ("After" this week)

- Features that will be added *after* p11.07.00
  - Access to calibration databases for
    - SMT
    - CFT
    - CPS?
    - Goal: two weeks after p11.07.00 running on farm
  - Any enhancement required to deal with detector operation / commissioning
  - Bug fixes

Current Status ("After" this week)

- Some RECO performance numbers (projected for p11.07.00)
  - Data, Run 147897
    - CPU time: ~ 15 sec/evt (500 MHz PIII, optimized)
      - 53 % Tracking, 20 % PID
    - Event size: 900 Kb (depends on detector status)
      - RAW: 147 Kb
      - SMT clusters: 460 Kb
      - Tracks extrapolated to Cal: 40 Kb
      - Cal data: 36 Kb
      - Thumbnail: 21 Kb
      - …
    - Memory: 480 Mb (200 events)
  - MC, $Z(\mu\mu) + 0$ mb
    - CPU: ~ 20 sec/evt, 34 % tracking, 38 % PID
    - Event size: 1.3 Mb
    - Memory: 360 Mb (200 events)
  - MC, ttbar + 2.5 mb, (p10.15.00)
    - CPU: 220 sec/evt, 57% tracking, 13% VTX, 22% PID
    - Event size: 2.3 Mb
    - Memory: 640 Mb (200 events)

> Several standard samples used for benchmarking. Will measure all when p11.07.00 is ready.

Tracking Performance for p11.06.00

GTR perf vs nbg for p11.06.00 with cut_p0.5_full.dat for p09.08_zmm0m.root, ...
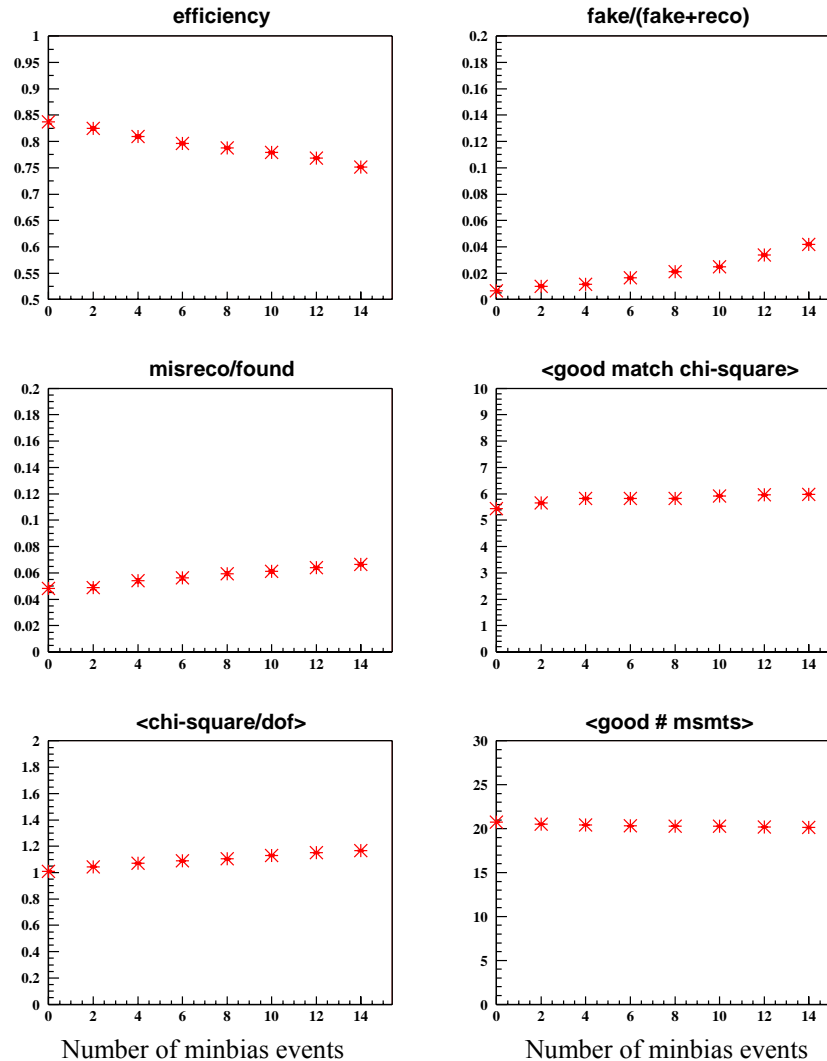
Low p_T tracks
Performance vs # mb

Monte Carlo
Z($\mu\mu$)
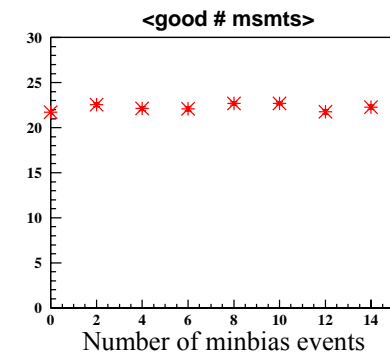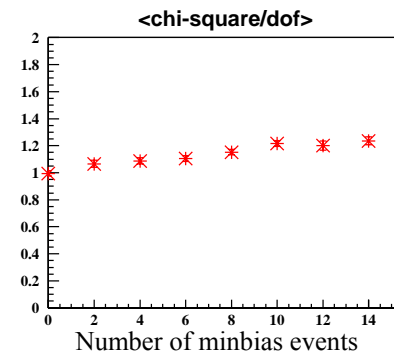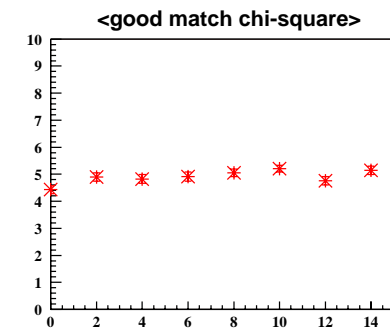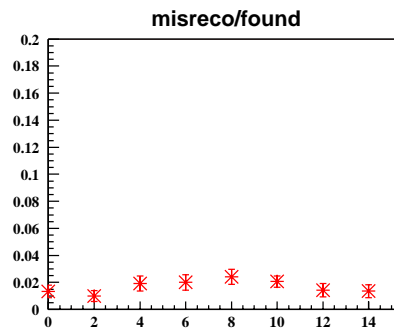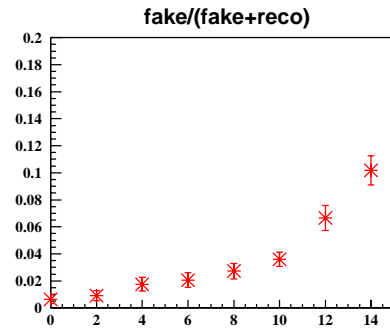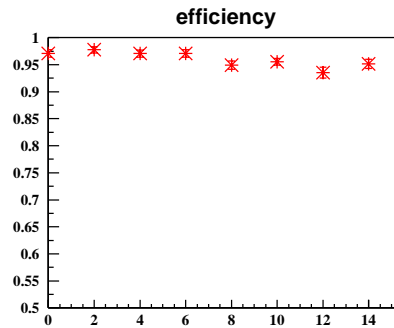p11.06.00

p11.07.00 will change a little

Tracking Performance for p11.06.00

GTR perf vs nbg for p11.06.00 with cut_zmumu_full.dat for p09.08_zmm0m.root, ...

Efficiency in data not well known. 80% ? Lower ? Under study…
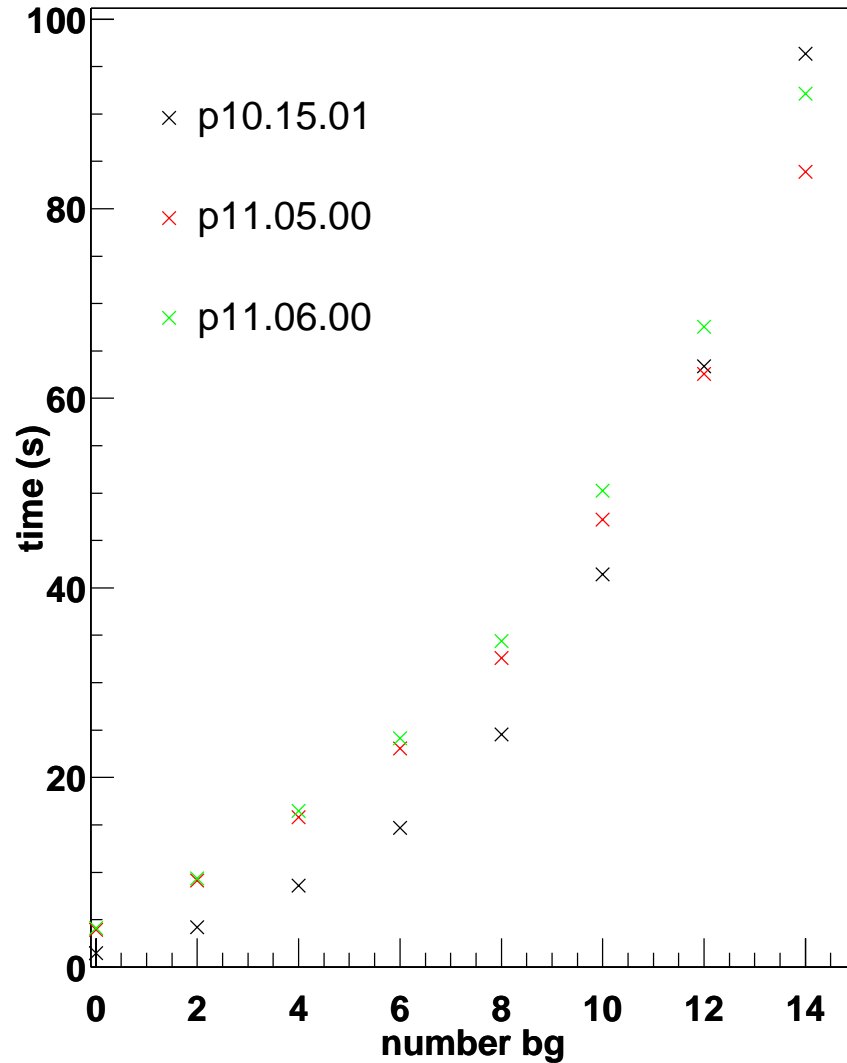
Monte Carlo
$Z(\mu\mu)$
p11.06.00

High p_T tracks
Performance vs # mb

Tracking Performance for p11.06.00

CPU time vs. # minbias

GTR timing for total

Monte Carlo
$Z(\mu\mu)$

Legend:
- × p10.15.01
- × p11.05.00
- × p11.06.00

y-axis: **time (s)**, 0 to 100
x-axis: **number bg**, 0 to 14

Schedule

- p11
  - May 7, 2002 - p11.07.00 build begins
  - May 21, 2002 – p11.07.00 installed on farms for real data processing
  - June 4, 2002 – p11.??.00 installed on farms with calibration database access
- p12
  - July 29, 2002 – p12 installed on farms
- p13
  - October 28, 2002 – p13 installed on farms

  p13 will be available for processing data taken after October, 2002 shutdown.
  Can be considered **Version 1** of *Physics Quality* reconstruction.

Strategy for scheduling RECO releases

- Make a schedule that is **predictable**.

- Allow for **reasonable development time**.

- Allow for **reasonable deployment time** for new features.

- Weekly development releases and quarterly production releases.

- Provides two month development + one month integration / testing / documentation.

- Still allow for "exceptional enhancements"

- Don't explicitly link schedule to conferences.

- Development schedule does not have to corresponding to deployment schedule.

- After p13, will be very difficult to *deploy* major changes.

Issues – Current Performance

- Some known outstanding problems
  - Tracking
    - Efficiency for low p_T tracks
    - Efficiency for tracks from long lived particles (K^0, "γ conversions", etc.)
    - Efficiency for tracks in jets
    - Efficiency for tracks in data vs. Monte Carlo (not well known)
    - CPU time rise vs. luminosity
  - Vertexing
    - Split vertices
  - All algorithms – just started to tune result to data, very little data / MC comparisons
  - No ability to use physics objects to revertex
    - e.g. Supply vertex based on high p_T lepton(s) (W, Z events)
  - No DST
  - Memory leaks, memory required to link

Issues - Manpower

- In August, 2002, Algorithms / Object ID groups were asked
  - What is level of current effort (FTE)?
  - What additional level is required?

August 30, 2001

Algorithms Effort Report - August, 2001						
Group	Active FTE	Projected	Additional Needed	Additional / Needed	Total Required	Notes
Align	3.15	3.00	10.30	3.43	13.30	1)
Calib	3.25	3.50	1.25	0.36	4.75	1)
SMT	1.60	1.70	2.50	1.47	4.20	
CFT	1.20	0.70	2.00	2.86	2.70	
CAL	0.00	0.00	0.00	?	0.00	3)
MUO	12.55	10.15	1.70	0.17	11.85	
GTR	4.75	3.30	3.35	1.02	6.65	
VTX	2.45	2.70	1.00	0.37	3.70	
JET	0.00	0.00	0.00	?	0.00	3)
EMID	11.85	12.25	2.50	0.20	14.75	
MUID	2.85	2.95	2.50	0.85	5.45	
TAUID	0.00	0.00	0.00	?	0.00	3)
BID	3.05	4.20	1.00	0.24	5.20	
JES	0.00	0.00	0.00	?	0.00	3)
L3	5.20	6.30	10.15	1.61	16.45	2)
Total	**51.90**	**50.75**	**38.25**		**89.00**	

Estimated number of additional people: **92**

Active: Actual efforts over last three months
Projected: Committed manpower for next three months
Additional: Estimated needs for next three months

Notes:
1) Some Calib/Align effort is included in detector groups.
2) Some L3 effort is included in detector groups.
3) No report supplied from group yet.
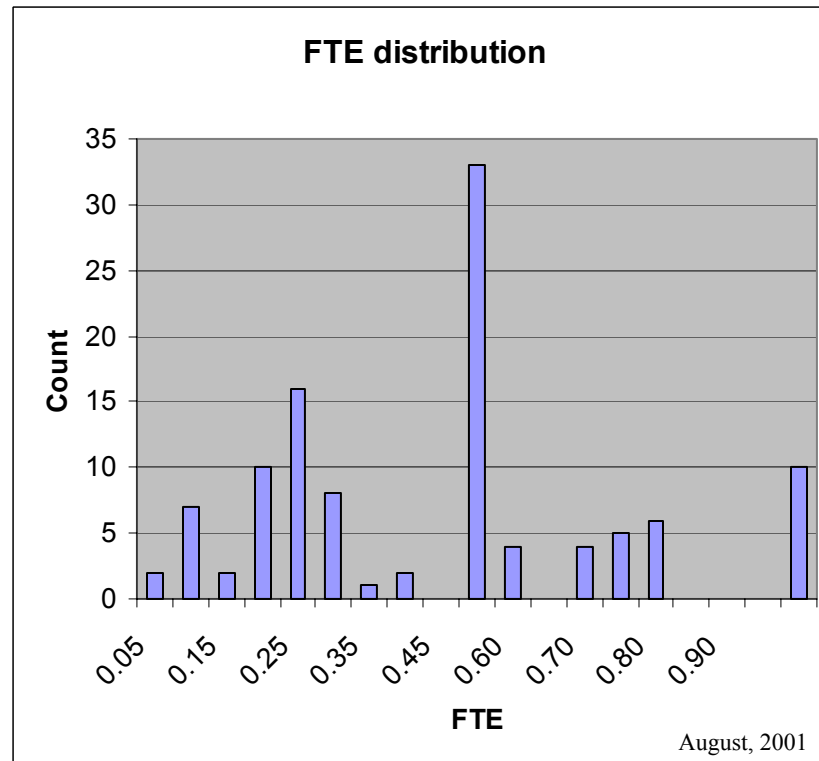4) Estimated number of people = (Additional Needed) / (avg FTE/person achieved)

~ 30 additional FTE's required for RECO

10 for L3

Issues - Manpower

Distribution of existing FTE's committed to Algorithms

FTE distribution

August, 2001

Issues – Project Management

- Must move from interrupt-driven project management to real project management (goals, schedules, measurable milestones, reviews, reallocation of resources as required, etc.).

- Hopefully, with the detector / readout complete, this can happen. We "survived" a very difficult period. Have we lived through the "last symptom" of the hardware delays?

- Recently, there has been very little top-down setting of goals. Individual groups have set their own internal agendas. This doesn't create a very coherent, collaboration-wide atmosphere. Need to change this.

- Current organization may create some problems. Object ID groups report to Physics Coordinator, but develop code for RECO. There is tension between short-term physics goals and long-term reco development. Not necessarily a bad thing, but something to be aware of.

- Also, current organization seems to "reward" Object ID groups, since they are seen at the same level as Physics groups. But lower level Algo groups are part of a different organization, and don't seem to get the same attention. Also, there seems to continue to be a "vapor pressure" that keeps people away from "the nitty-gritty", especially now and through the next six (?) months.

- Currently relying on a good working relationship between the various leaders of the groups. But there has been confusion. Do we have the most effective organization? Do we understand it?

Issues – Run IIb

- Accelerator / detector will not give a one year (+) startup time for software.

- Collaboration must be willing to commit appropriate manpower on appropriate timescale. There can be no excuses.

- Although effort will be less than IIa, it will not be insignificant.

- There will need to be *committed* software effort before, during and after installation of new detectors.

Conclusions

- RECO *is* reconstructing collider and Monte Carlo events.

- *Many* objects are being reconstructed
  - Tracks, vertices, electrons, photons, muons, taus, MET, jets, b/c jets

- "**Physics results**" presented at Winter Conferences

- Major new version scheduled for **May 21, 2002**

- Making transition from detector / software commissioning into physics data taking. Delays in detector / electronics had big impact on software as well. Not completely through this period yet.

- Many tasks remain to be completed.

- Major worries: efficiencies, CPU time vs. luminosity, memory, DST, manpower

- And what we don't know yet (which is a lot)…

- Major deadline: p13 (October, 2002) – "**Physics Ready**"